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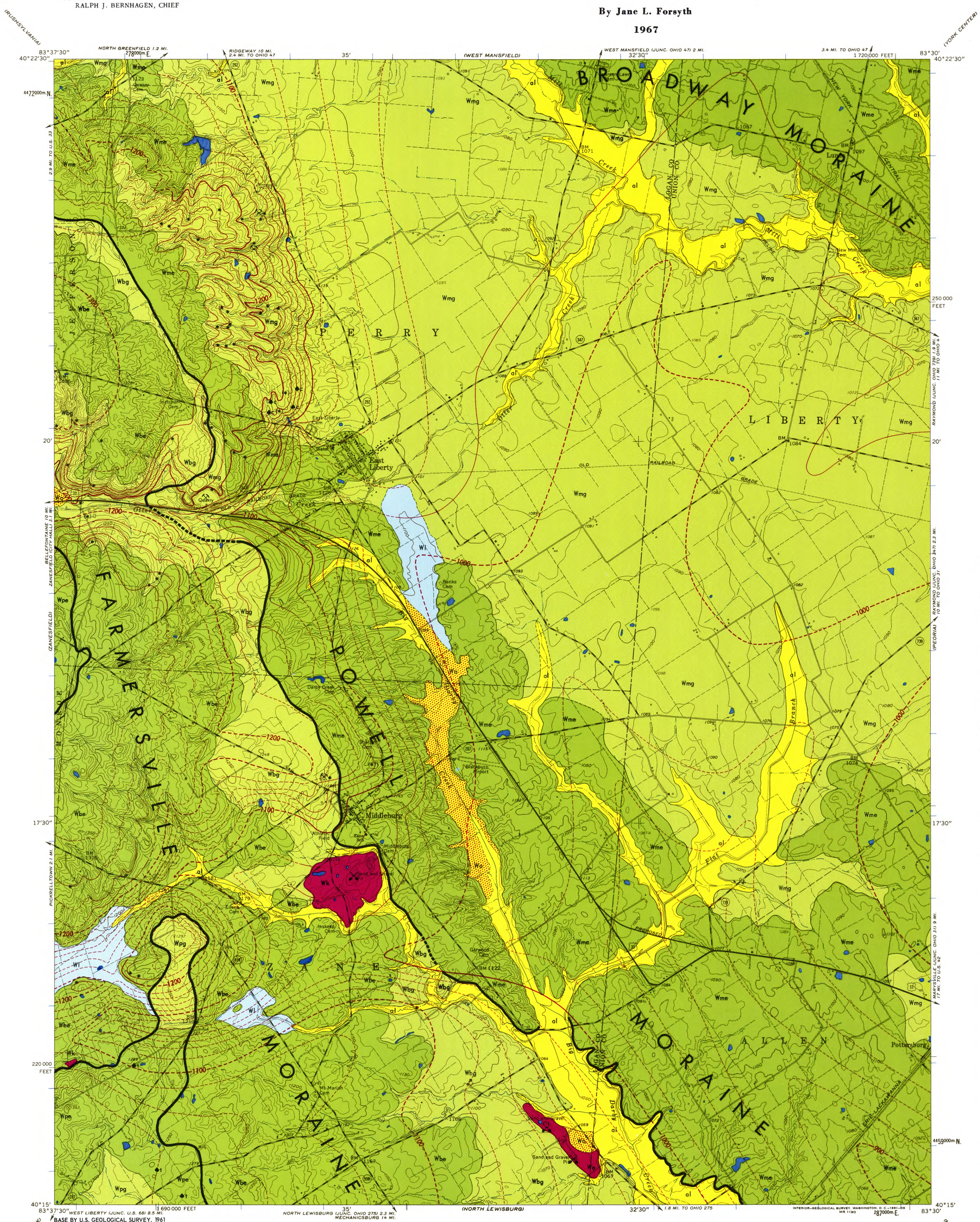
GLACIAL GEOLOGY OF THE EAST LIBERTY QUADRANGLE, LOGAN AND UNION COUNTIES, OHIO

By Jane L. Forsyth

1967

OHIO DIVISION OF GEOLOGICAL SURVEY
REPORT OF INVESTIGATIONS NO. 66

GLACIAL GEOLOGY OF THE
EAST LIBERTY QUADRANGLE, OHIO



EXPLANATION

Recent	al	Stream alluvium
Pleistocene (Wisconsin)	Wl	Lake silt
	Wo	Outwash sand or gravel
	Wk	Kame
	We	Esker
	Wme Wmg	Marysville Till Wme, *end moraine* Wmg, *ground moraine*
	Wbe Wbg	Bellefontaine Till Wbe, *end moraine* Wbg, *ground moraine*
	Wpe Wpg	Pickrelltown Till Wpe, *end moraine* Wpg, *ground moraine*

QUATERNARY

Boundary of deposit, *dashed where approximate*

Boundary of Marysville, Bellefontaine, or Pickrelltown Till, *dashed where approximate*

Contour on bedrock surface, *dashed where appraximate; contour interval 20 feet*

Quarry, *active*

Quarry, *inactive*

Gravel pit, *inactive*

* Bedrock exposure

(*) Bedrock shallow, *based on evidence of indicator trees*

Some locations of certain indicator trees

♣c Cedar (*Juniperus virginiana*)

♣t Tulip poplar (*Liriodendron tulipifera*)

GLACIAL GEOLOGY

INTRODUCTION

The eastern half of the East Liberty quadrangle area is generally flat. The western half, however, lies on the eastern edge of a bedrock-controlled upland, the Bellefontaine outlier, and steeper slopes occur there because of the resistance of the underlying bedrock. Bedrock units are the Ohio Shale and, below it, the Columbus limestone, both of Devonian age. The shale is exposed in small valleys north and south of Otter Creek valley and in the large limestone quarry just west of East Liberty, where a few inches of shale locally caps the limestone. The limestone is best exposed in the East Liberty quarry, but it is also locally visible in abandoned quarries, road cuts, and small natural outcrops.

GLACIAL DEPOSITS

No pre-Wisconsin drift has been recognized in this map area, although there is no question, on the basis of deposits elsewhere in the State, that one and probably two pre-Wisconsin glaciers advanced southward through the region. It is quite possible that Illinoian or Kansan materials may be preserved at depth in areas of thick drift.

Early Wisconsin drift as identified elsewhere in western Ohio by Forsyth (1965, p. 225) has not been found in this area. Three late Wisconsin tills have been recognized and are the same as those previously reported in other areas of western Ohio; they are identified by their physical composition and distribution, and by the soils developed in them (Forsyth, 1965). In addition, the presence of certain trees and tree associations, in situations where disturbance by man has not completely destroyed the original soils-related vegetation, was found to be helpful in distinguishing these tills, particularly in areas lacking adequate exposures. Identification of tills by use of the relatively new tool of vegetation must be done cautiously. Where different species of trees grow depends mainly on the physical and chemical nature of the ground; only where geologic deposits remain essentially uniform and where little disturbance has taken place may cautious inferences be attempted.

Oldest of the tills is the Pickrelltown Till, which is characterized by a loam texture and abundant limestone pebbles, and by Miami 6D soils, leached an average of 36 inches and generally having somewhat brighter weathering colors (7.5-10YR 4/4) than do soils in the younger tills (10YR 4/3) (Munsell soil color charts, 1954). Where this till is not too much disturbed, the associated vegetation is a mixture of beech (*Fagus grandifolia*) and sugar maple (*Acer saccharum*), with some bitternut-type hickory (*Carya cordiformis?*) and scattered tulip poplar (*Liriodendron tulipifera*). Although tulip poplar is essentially restricted to the Pickrelltown Till, the tree grows only where a fairly thick section of Ohio Shale separates the drift from the underlying limestone bedrock; where the drift lies directly on the limestone, tulip poplar is consistently absent. This till occurs only on the higher areas of the Bellefontaine upland, in the most western part of the quadrangle area.

The next younger till, the Bellefontaine, has a pebbly loam texture like that of the Pickrelltown Till, but has developed in it Miami 6A soils, leached an average of only 25 inches. Characteristic vegetation associated with this till is sugar maple, in many places in almost solid stands. There is little or no beech; some shagbark hickory (*Carya ovata*) is present. The Bellefontaine Till occurs in a broad belt extending diagonally northwest-southeast across the southwestern part of the area.

The youngest till, the Marysville Till, is very clay rich, with few pebbles. It is the only one of the three tills that can be identified without reference to its soils, which are the Miami 6B (Morley-Blount) soils, leached an average of 24 inches. Characteristic associated vegetation is typical upland swamp forest: pin oak (*Quercus palustris*), white ash (*Fraxinus americana*), shagbark hickory, American elm (*Ulmus americana*), silver maple (*Acer saccharinum*), cottonwood (*Populus deltoides*), swamp white oak (*Quercus bicolor*), and locally bur oak (*Quercus macrocarpa*).

The names of all three tills are taken from towns situated well within broad areas where the tills occur typically. These towns are Marysville, about 7 miles southeast of the East Liberty quadrangle area, and Pickrelltown and Bellefontaine, 2 miles and 7 miles, respectively, to the west.

These tills are present as both ground moraine and end moraine. The orientation of the latter reflects the control of the bedrock upland to the west. Small streams tend to follow the outer edges of the end moraines, a pattern believed to have originated when the glacial margins stood at the positions of the moraines. Both the Farmersville Moraine and some unnamed end moraine composed of Pickrelltown Till are included in what in the past has generally been called the Cable Moraine.

Greater numbers of boulders (small map) are present in association with the two older tills than with the younger. Mapping farther west in the State (Goldthwait and others, 1961) has shown that the Farmersville Moraine there is marked by a strong boulder belt; thus the presence of large numbers of boulders in association with the same moraine here is expectable. There are also a fair number of boulders in the area of the Pickrelltown Till, but these may represent only concentrations of boulders along the edge of the Farmersville ice. Scattered boulders are present in only a few places over most of the area of Marysville Till, but on the Broadway Moraine, although boulders are few in number, they consistently occur almost everywhere.

Only a few deposits of sand and gravel occur in the map area. Outwash, poorly sorted and in many places containing associated silt, is found along Big Darby Creek and in two small areas near the southern edge and near the western edge of the map area. The last is the easternmost corner of a broad outwash deposit that extends westward from this point and then south down the Mad River valley in the adjoining quadrangle area. The gravel of this deposit is better sorted than that of the other deposits. A moderately large area of kames, all capped by Bellefontaine Till, occurs southwest of Middleburg and a very small kame is present near the southwestern corner of the map area. There is one esker, located near the southern edge.

Three areas of lake deposits are shown. Actually, it is unlikely that any of these areas was ever covered by a significant depth of water. Rather, these were low swampy areas into which surface water moved during wet periods, washing in silt. The deposits in the area 1 mile southwest of Middleburg contain a thin layer of peat and the area was probably, in part, a large kettle hole. The lake deposits at the western edge of the map area are in the eastern end of a valley which carried meltwater and gravel outwash westward into the Mad River valley.

On the "Glacial Map of Ohio" (Goldthwait and others, 1961), another area of lake deposits, based on earlier mapping by Forsyth (1956), is shown northeast of East Liberty. During remapping, enough pebbles were seen in the clayey material to make an interpretation of clay-rich till preferable to one of lake clay. There is no question, however, that there was a lake northeast of East Liberty at a somewhat earlier stage, because the Marysville Till in the area directly to the south and to the southeast (near Marysville) is so high in clay that some such immediate source of clay must have been available.

BEDROCK SURFACE

The high bedrock hills of the Devonian outlier are shown more clearly by the bedrock contours than by the surface topography. The abundance of natural limestone exposures in the area northwest of East Liberty has permitted an especially valid mapping of the buried bedrock surface there. Southeast from East Liberty, data are few and are generally from wells that do not reach the buried bedrock surface, with the result that contours are very generalized and uncertain in that area. Locally limestone-indicator trees have been used as guides to the depth of of the rock. Red cedar (*Juniperus virginiana*) and large healthy black walnut (*Juglans nigra*) specifically indicate shallow limestone or dolomite bedrock, although cedar may also grow where the soil is badly eroded; hackberry (*Celtis occidentalis*) occurs over limestone or dolomite in the form of either bedrock or gravel. Despite the unequal validity of the bedrock contours, it is clear both that local slopes on the buried bedrock surface are very steep and that the general preglacial drainage was to the southeast.

MINERAL RESOURCES

The main mineral product of the East Liberty quadrangle area is limestone, as indicated by the large active quarry at East Liberty and the numerous small abandoned quarries elsewhere. Shale has not been quarried here, although there is an old quarry in the shale only a few miles west of the quadrangle boundary.

Sand and gravel are not produced in the area today, but the kames and esker all have old pits in them and show evidence of occasional modern activity. These gravels are not of high quality; they contain some boulders and a moderate percentage of fines as well as some deleterious materials. The gravel, however, is of better quality than that in the outwash deposits shown on this map, because the outwash gravels are all extremely poorly sorted, with high percentages of fines.

The Marysville Till is clay rich throughout the area of its occurrence, but it is especially high in clay in the eastern half of this quadrangle area. A typical sample of this till was collected at a depth of approximately 3 feet, 2 miles northeast of East Liberty, and was evaluated for its ceramic potential by Dr. David Webb of the Division of Geological Survey. On the basis of the test data, the Marysville Till is not recommended for ceramic use. The principal objections are the occurrence of cracking and popouts, the short maturing temperature range, the presence of calcareous matter, and the light-olive-brown fired color.

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BASE BY U.S. GEOLOGICAL SURVEY, 1961

10,000-foot grid based on Ohio coordinate system, north zone
1000-meter Universal Transverse Mercator grid ticks,
zone 17, shown in blue

SCALE 1:24 000

1 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

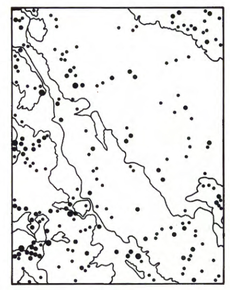
1 5 0 1 KILOMETER

CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL

1½° MAGNETIC NORTH TRUE NORTH

APPROXIMATE MEAN DECLINATION, 1961

Quadrangle Location



DISTRIBUTION OF BOULDERS

Lack of boulder data in some spots in the western part of the map is due to incomplete mapping between the rather widely spaced roads.

- 1-4 boulders per acre
- 5-12 boulders per acre
- >12 boulders per acre

Cartographic drafting by
Philip Celnar

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